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1 RECORD OF ORAL HEARING
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3 UNITED STATES PATENT AND TRADEMARK OFFICE
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6 BEFORE THE BOARD OF PATENT APPEALS
7 AND INTERFERENCES
8

9
10 Ex parte TETSUNORI KAJI,
11 SHINICHI TACHI,
12 TORU OTSUBO,
13 KATSUYA WATANABE,
14 KATSUHIKO MITANI,
15 and JUNICHI TANAKA
16

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18 Appeal 2009-003033
19 Application 10/808,559
20 Technology Center 1700
21

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23 Oral Hearing Held: June 25, 2009
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27 Before JEFFREY T. SMITH, MARK NAGUMO, and
28 MICHAEL P. COLAIANNI, Administrative Patent Judges
29

30 ON BEHALF OF THE APPELLANT:
31

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1 The above-entitled matter came on for hearing on Thursday,
2 June 25, 2009, commencing at 1:27 p.m., at the U.S. Patent and Trademark
3 Office, 600 Dulany Street, Alexandria, Virginia, before Victoria L. Wilson,
4 Notary Public.

5 THE USHER: Calendar number 71. Mr. Montone.

6 JUDGE SMITH: Welcome, Mr. Montone.

7 MR. MONTONE: Good afternoon.

8 JUDGE SMITH: After you get settled, as you know, you have 20
9 minutes to present your arguments.

10 MR. MONTONE: Okay. Well, yes, it is pretty straightforward, this
11 case, so hopefully it won't take that long.

12 Essentially, this particular appeal is directed to – this case is sort of a
13 treasure trove of disclosure.

14 It was one of the very early applications in this area and there is really
15 quite a number of things in here, if you read the spec, but what we are
16 concentrating on today in all of our claims is an improved plasma discharge
17 confinement ring, and if you refer to the drawings, figure 1, for example,
18 you can see this structure identified with the numeral 37 and, effectively,
19 that is a ring that goes around a plasma -- a plasma area where you will be
20 doing etching of a wafer and, in the past, as you can see from the prior art
21 that's been cited, there have been so-called confinement -- plasma
22 confinement rings.

23 The main difference, as we will discuss shortly here, is that in the
24 past, what they are mostly looking to do is just keep the plasma in the area of
25 where you are etching. They don't want the plasma to go outside of it.

26 What the present claims are directed to is going beyond that, and as

1 you can see from figure 1, 37 really substantially completely shuts off the
2 etching chamber, with the exception of a very small opening which is used
3 when you eventually want to evacuate the chamber.

4 In so doing, as the Applicants discuss in the specification, the purpose
5 that they are seeking is to increase the plasma density inside that etching
6 chamber rather than just holding the plasma in there. So let me go ahead and
7 -- if you refer, for example, to page 40, line 2, of the specification -- which I
8 will find here in a moment -- okay -- I apologize -- what that says, in regard
9 to the surrounding of the processing chamber, 10, since the plasma is
10 confined in the vicinity of the sample, 40, by the discharge confining ring,
11 37, the plasma density is increased and the attaching of unnecessary deposits
12 to portions outside the discharge confining ring, 37, is minimized.

13 So that's the one important aspect of the present claims is having this
14 confinement ring not only confined but confined to the extent that as the gas
15 is coming in, it will actually be having its density increased.

16 JUDGE NAGUMO: So does this mean that the -- because this
17 confining ring actually exerts the force somehow on the plasma so that it is
18 denser or --

19 MR. MONTONE: Well, the gas is being pumped in and then
20 essentially ignited and it will hit the wall and because it is trying to expand
21 and it is being held in, for the most part, the pressure, the density will
22 actually increase in there.

23 JUDGE NAGUMO: Okay. So why isn't that fully met by Lenz
24 which shows a set of rings very much like that? You just said it is a wall.

25 MR. MONTONE: Okay. Well, we will get into that in great detail.
26 Okay. Well, before I go on to that, I want to mention one other thing that

1 the claims contain and because it is sort of a secondary but still significant
2 issue is that these rings or this confinement ring in this case is constructed of
3 silicon carbide.

4 In particular, it is constructed of a material that doesn't have oxygen
5 because in the course of all of this, there is a declaration that was submitted
6 in here, the rings in the primary reference to Lenz are constructed of quartz
7 or silica, both of which contain oxygen.

8 The problem with that is as you increase the density and you start
9 etching with increased density, you are going to start to etch the discharge
10 confinement ring itself.

11 If you have oxygen, which both quartz and silica do, which Lenz 571
12 does, then you would actually start to physically put oxygen into the plasma,
13 which you don't want.

14 We don't think that Lenz has that problem because Lenz does not
15 appear to be operating at the same high density.

16 Okay. Turning to your question, Mr. Nagumo, of the Lenz '751, the
17 confinement ring here, there is nothing in here that suggests that these rings
18 will increase the density.

19 In fact, we think quite the opposite. If you look at figures 1 and 2 of
20 Lenz, what you see is that the slots, gaps, as it were, 31, play a very, very
21 critical role for Lenz '751. Basically, especially if you look at figure 2 of
22 Lenz '751, you can see that what you have is these rings, which are, as I
23 mentioned before, made of silica or quartz, which has oxygen, will generate
24 oxygen when etched, and they are spaced apart by specific -- well, you can
25 really see here that the gaps are, basically, almost as big as the rings.

26 JUDGE NAGUMO: But all I need by the claim is to increase plasma

1 density. Presumably that's with compared to nothing at all.

2 So I have got a substantial wall here, it may have a lot of holes in it,
3 and if the primary action is purely physical, reflective wall, largely reflective
4 wall, then it seems that I would meet that but for the composition and it is
5 my understanding that one of the other Lenz references suggests silicon
6 carbide as an equivalent material for this wall and so why is that not prima
7 facie obvious?

8 MR. MONTONE: I understand your question. I think in response to
9 the first part of your question, I tried to equate this to filling up a glass of
10 water.

11 If the glass has all of these slots in it -- just picture that structure there
12 as a glass. What's going to happen is as you pour it in, it is just going to
13 come pouring out. The density inside is not going to increase or, at the
14 minimum, they had no interest whatsoever.

15 If there is some minor increase, but I kind of doubt it, what Lenz does
16 -- it is really fascinating -- I kind of like this invention -- if you look at it,
17 you see in the abstract, it says, "The dimensions of the slot are chosen to
18 ensure that the charge particles of spent gases in the plasma, the interaction
19 spaces, are neutralized by wall collisions as they exit the slots," and he goes
20 on in column 2 to expound on that. Let me just read this to you.

21 I'm on column 2, line 23, et seq. there, it says,

22 "Moreover, the slots that are formed are appropriately proportioned
23 such that the distance of charge gas particles from the plasma must travel in
24 the slot and exiting a substantially longer than the mean-free path of the
25 particles so that the exiting particles make at least one collision with the
26 walls of the slots. These collisions with the walls will neutralize the charges

1 on the particles and the exiting particles are neutral."

2 So he has got this kind of fascinating system that plasma comes in, he
3 ignites it and, of course, it is going to start to exhaust and as it is exhausting,
4 he designs those slots very specifically so that they neutralize the charge.

5 So what comes out? The plasma won't be there in its plasma form
6 when it comes out. That's what he is getting at which is -- which is great. It
7 is -- but it is a wholly different way. There is nothing in here about
8 increasing density.

9 JUDGE NAGUMO: But what's the evidence that the density would
10 not, in fact, be increased? It only needs to be increased by a small amount
11 relative to nothing and so if I have got 90 percent of the container -- the open
12 area of the container is some sort of a wall and we know that it has a
13 substantial thickness because the mean-free path of -- it is substantially
14 thicker than the mean-free path of the molecule.

15 So it is not just going to all stream out, it is going to go out, I would
16 argue, somewhat slowly, it seems, so I still don't see that we are getting --
17 that we aren't reasonably having an increased density --

18 MR. MONTONE: Some increase.

19 JUDGE NAGUMO: -- as the claim 1 -- actually, I guess it is claim 8
20 actually requires.

21 MR. MONTONE: Well, yes, there is -- you know, all we can really
22 say is that the structure is literally filled with holes.

23 There is no disclosure or no interest whatsoever in increasing density
24 and we have an invention which is specifically designed to design a plasma
25 confinement ring which will also increase density.

26 In the case of claim 28, which is the most specific claim, it

1 particularly defines the range in which the density is confined to, the range
2 that you are seeking, and one of the problems in the prior art is that that --

3 JUDGE SMITH: With regard to claim 28, that's a condition of the
4 structure. That's not a limitation on the claim, per se. That means you must
5 have a system -- a structure that's capable, in this case an apparatus, that's
6 capable of providing such a plasma.

7 MR. MONTONE: Well, what we have is a means. We put it in a
8 functional format just to --

9 JUDGE SMITH: Okay.

10 MR. MONTONE: -- cover that -- that's what we are doing so you
11 wouldn't, you know, be given weight in terms of that function limitation.

12 JUDGE SMITH: Have you defined the means?

13 MR. MONTONE: Huh?

14 JUDGE SMITH: Have you defined the means?

15 MR. MONTONE: In claim 28 -- well, the means is actually the
16 combination of the plasma generation electrodes and the plasma confining
17 ring, so that, otherwise, if you didn't have this confinement in there, you
18 wouldn't have that density.

19 JUDGE SMITH: Does the Lenz '751 patent describe how many rings
20 are necessary for their invention?

21 MR. MONTONE: I believe they mention six rings as their preferred
22 embodiment.

23 In column 2, they say, "confinement at least 3 dielectric rings spaced
24 apart in a manner essentially to form a circular ring having at least a pair of
25 circumferential slots, in addition to the slots. In typical embodiments, six
26 rings were used to form five distinct circumferential slots," et cetera.

1 JUDGE SMITH: Have you established of the three rings, that such a
2 plasma density could not be achieved?

3 MR. MONTONE: No, we don't have -- you know, we don't have any
4 specific evidence that says that you would not get an increase in plasma
5 density.

6 The reference doesn't have any teaching or even remote interest in
7 increasing plasma density, so -- so I guess that's kind of where we stand
8 now.

9 JUDGE SMITH: But what is the point of a containment ring if it is
10 not to contain the dense --

11 MR. MONTONE: That's a very good question. The fundamental
12 question, why do they call it "confinement ring."

13 The reason they call it "confinement" is because they want to keep the
14 plasma inside and that's what I like about Lenz. I think it is just kind of
15 fascinating that they design these slots so that as the gas flows out, it is
16 neutralized.

17 So it is plasma on the inside -- I mean if you picture this -- that's
18 what's interesting.

19 If you take this cup and you put slots all the way around it and you
20 pour water in, you will have water inside and you will have water outside.

21 In Lenz, basically, yes, you still have the material but they put it in so
22 you have plasma inside and no plasma outside, notwithstanding all of those
23 slots, and they --

24 JUDGE NAGUMO: I would submit a closer picture might be a leaky
25 balloon that you are pumping air into or hot air into, maybe ballooning it.
26 It's got holes in it so air is streaming out but you are pumping air into it at

1 the same time, so as long as you are –

2 MR. MONTONE: That's our invention. Actually, that's the
3 difference. Our invention is more like that balloon with the little hole that's
4 expanding, but you confine the size of it so the density inside increases and,
5 yes, there is a little leak going out but it is very, very slow and that's why we
6 have it. Their's is the slotted cup.

7 JUDGE NAGUMO: Well, that's the argument here --

8 MR. MONTONE: Yes, that's the argument.

9 JUDGE NAGUMO: -- how slotted is it. If we could go to the
10 composition aspect because you raised it earlier and the claim requires
11 silicon carbide.

12 MR. MONTONE: Right.

13 JUDGE NAGUMO: And is it Lenz '5 --

14 JUDGE SMITH: '356.

15 JUDGE NAGUMO: -- '356, I believe.

16 MR. MONTONE: '356, yes, and that's an interesting question.

17 JUDGE NAGUMO: And if you could address that.

18 MR. MONTONE: Obviously, Lenz knew about silicon carbide but
19 he did not use it. He specifically taught I want it to be silica or quartz. He is
20 quite emphatic about that, notwithstanding the fact that his earlier patent
21 used a related structure.

22 Our conclusion from that is that he must have decided that that
23 material doesn't work as well to create these collisions. Why, I have no idea.
24 But if he was so aware of it, why wouldn't he have suggested it.

25 JUDGE SMITH: Lenz '751 in column 6 says that it should be made
26 of a dielectric, preferably silica or quartz.

1 MR. MONTONE: Right.

2 JUDGE SMITH: So that's a preferred embodiment.

3 MR. MONTONE: That's true. He doesn't rule it out.

4 JUDGE SMITH: So is silicon carbide a dielectric as Lenz '356 says?

5 MR. MONTONE: Yes. Yes. So it is true, and that's why I said that's
6 kind of a subsidiary argument. Our -- our principal argument really comes
7 down to the fact that in Lenz, you have got -- if you look at figure 2
8 especially, you have got what is obviously a very leaky structure.

9 You have got an arrangement very specifically designed concerning
10 the size of those big slots to neutralize the plasma as it comes out, and that if
11 you start to, for lack of a better word, mess with Lenz to change those slots
12 to increase density inside the chamber, you will totally destroy the purpose
13 of Lenz because that's not what he wants to do.

14 So that's kind of it. And, you know, I guess all I can really ask you to
15 do is hopefully -- our view of it is that we are talking about this cup with
16 water coming in and all of these slots as compared with the balloon analogy
17 that you set forth, except that you limit the size that the balloon can expand
18 to and there is only this one hole so, boom, it comes out. We specifically
19 designed it to increase the plasma density and, in particular, to increase it to
20 a particular level and allow you to maintain a level as defined in claim 28.

21 JUDGE SMITH: Do you have a depiction of the vacuuming portion
22 in your figures?

23 MR. MONTONE: I don't think so. I mean we sort of have a
24 schematic in figure 40 as to gas coming in and going out.

25 JUDGE SMITH: Looking at figure 39, and I presume the plasma
26 chamber is identified as 10 therein --

1 MR. MONTONE: Okay. Yeah.

2 JUDGE SMITH: -- would the openings on each side be considered
3 your opening?

4 MR. MONTONE: Yep. Yeah, exactly, and then there is this outer
5 chamber that goes into and then it gets evacuated.

6 JUDGE SMITH: Right.

7 MR. MONTONE: So --

8 JUDGE SMITH: Do you have anything else?

9 MR. MONTONE: No. That's it.

10 All right, gentlemen, thank you.

11 JUDGE NAGUMO: Thank you.

12 JUDGE SMITH: Thank you.

13 Whereupon, the proceedings at 1:46 p.m. were concluded.